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ABSTRACT

This paper discusses the implications of Lucy Suchman's conclusion that a theory of situated action--i.e., the actual sense that specific users make out of specific Xeroxing events--is truer to the lived experience of Xerox users than a cognitive account of the user's plans--e.g., the hierarchy of subprocedures for how Xerox machines should be used. It is argued that this distinction poses a challenge for cognitively based instructional design because it leads to two questions: whether instructional plans should be designed into instructional systems in order to control instructional interactions when the users of such systems learn in a situated-action manner and not in a plan-based manner, and whether any instructional or learning theory should be used to guide the actions of teachers or learners. Suchman's ideas about plans and situated actions, as well as the implications of these ideas for the design and use of instructional systems, are discussed under the following subheadings: plans and instructional systems; the problematic of plans and instructional practice; plans and situated actions; and plans and situated learning. A brief analysis of the work of John Seely Brown, who is a colleague of Suchman at the Xerox Palo Alto (California) Research Center and one of the founders of the field of intelligent tutoring systems, is then presented. The paper concludes with a discussion of Brown's contention that situated learning is a more accurate account of the phenomena of how people actually learn in the presence of intelligent tutoring systems than the cognitive theory of plans. Appended are 10 graphic representations of various topics discussed in the paper, e.g., the cognitivist paradigm, instructional systems, and aspects of cognition. (27 references) (CGD)

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Instructional Plans and Situated Learning:
The Challenge of Suchman's Theory of Situated Action for Instructional Designers and Instructional Systems

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Instructional Plans and Situated Learning:

The Challenge of Suchman's Theory of Situated Action

for Instructional Designers and Instructional Systems[1]

by

Michael J. Streibel[2]

Lucy Suchman is a researcher at Xerox PARC (Palo Alto Research Center) who studies how ordinary folks use Xerox machines that have built-in help and diagnosis programs. She distinguishes between plans (such as the hierarchy of sub-procedures for how Xerox machines should be used) and situated actions (i.e., the actual sense that specific users make out of specific Xeroxing events) and concludes that a theory of situated action is more true to the lived experience of Xerox users than a cognitive account of the user's plans (Suchman, 1987). Her distinction has profound implications for the discipline of Cognitive Science because cognitive scientists assume that plans are the essence of human actions. This assumption will be described throughout the paper as part of the cognitivist paradigm.

Suchman's distinction also poses a challenge for cognitively based Instructional Design because it leads to the following question: Do human beings such as teachers and learners follow plans (no matter how tentative or incomplete those plans might be) when they solve real-world problems or do human beings develop embodied skills that are only prospectively or retrospectively represented by plans? Suchman argues for the latter formulation. The question then becomes:

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Should instructional plans (e.g., drill-and-practice or expert tutoring instructional strategies) be designed into instructional systems in order to control instructional interactions when the users of such systems learn in a situated-action manner and not in a plan-based manner? Furthermore, should any theory (i.e., instructional or learning theory) be used to guide the actions of teachers or learners?

The remainder of the paper will discuss Suchman's ideas about plans and situated actions as well as the implications of these ideas for the design and use of instructional systems. The paper will end with a brief discussion of John Seely Brown's extension of Suchman's ideas and a general set of recommendations for instructional designers who want to remain sensitive to the epistemology of situated learning.

Plans and Instructional Systems

Cognitive science is an emerging specialty within educational psychology that merges ideas from information processing theory with disciplinary knowledge from computer science and artificial intelligence. Cognitive scientists make a number of assumptions about the world in order to conduct "normal science" in the Kuhnian sense of the term (Kuhn, 1970). For example, cognitive scientists treat mind as "neither substantial nor insubstantial, but as an abstractable structure implementable in any number of possible physical substrates" (Suchman, 1987). Furthermore, cognitive scientists treat the human mind as nothing but mental operations that mediate environmental stimuli and transform mental representations into other cognitive structures called plans which, in turn, produce behavioral responses (Suchman, 1987). Figure 1 provides a brief summary of the cognitivist model of mind.

Insert Figure 1 about here

The cognitivist paradigm also permits cognitive scientists to define learning as a change in cognitive structure and to study various lawful ways in which environmental stimuli can be manipulated in order to establish new cognitive structures (i.e., symbolic mental representations) and new cognitive operations (i.e., cognitive information processing). At the heart of the cognitivist paradigm, therefore, is the belief that the mind is a formal symbol manipulator that transforms symbolic representations into plan-based behavioral responses.

Several things are worth noting about the cognitivist paradigm. First, the cognitivist paradigm goes beyond the behaviorist paradigm in that it claims learning to be more than changes in external behavior. Learning is defined as changes in cognitive structures as evidenced by changes in external behavior. Gagne expresses this cognitivist orientation when he uses the concept of learned capabilities in instructional design (Gagne, 1987; Gagne, Briggs, & Wager, 1988). Second, cognitive structures or plans are treated as the causes of behavioral responses. Environmental stimuli still play a role, but more as information and triggering stimuli, than as causes of behavior. The computer is the root metaphor for this point of view because computer programs are the clearest expression of how plans can use input data to control external actions (Pylyshyn, 1984). Finally, the cognitivist paradigm opens the door for conceptualizing teaching and learning in information processing terms (Streibel, 1986). Each of these points will be elaborated below.

Instructional design theories such as Gagne's theory take the cognitivist paradigm one logical step further by claiming an instructional plan can generate the appropriate environmental stimuli and instructional interactions and thereby bring about a change in the cognitive structures and operations of the learner (Gagne, 1987; Gagne, Briggs, & Wager, 1988). Changes in cognitive structures and operations are inferred from the appearance of new (but prespecified) behavioral responses. Reigeluth articulates this next logical step when he describes the

prescriptive use of descriptive instructional theories (Reigeluth, 1983, 1987). Figure 2 shows a brief schematic of these ideas.

Insert Figure 2 about here

The cognitivist paradigm in instructional design also has a unified conception of the teacher and the learner. When instructional strategies are embodied in an instructional system, instruction is viewed as an information process that is coupled with the learner's cognitive processes via environmental stimuli. The essential aspect of the teacher, therefore, resides in the knowledge structures and instructional plans that he, she, or it (i.e., instructional system) contains. The essential aspect of the learner resides in the new cognitive knowledge structures and operations that he, she, or it (i.e., machine learning system) constructs. Instructional plans in the teacher and cognitive operations in the learner here are both conceptualized in information-processing terms. Figure 3 spells out this reconceptualization.

Insert Figure 3 about here

The logical extension of the cognitivist paradigm described above does not imply the instructional plan in the instructional system causes the changes in the learner's behavior. The learner is not a tabula rasa as in the behaviorist paradigm (Mackenzie, 1977). Rather, the interaction of the learner's cognitive operations within the entire process of the instructional system leads the learner to construct new cognitive structures and operations. The cognitivist paradigm remains fundamentally constructivist and individualistic as Piaget has shown in several of his writings (Piaget, 1968).

Finally, the cognitivist paradigm permits one to posit that behavioral

responses and cognitive structures and operations can be prespecified because both the teacher, the learner, and their interaction are theoretically described in identical information-processing terms. Suchman's discussion about plans and situated actions will question the whole cognitivist paradigm on this very point: Can the cognitivist paradigm provide an adequate conceptualization of human teaching and learning when these activities are fundamentally context-bound, situational activities and not context-free, plan-based activities? What is the problematic?

The Problematic of Plans and Instructional Practice

The problematic in the cognitivist scheme of things resides in the relationship between plans and situated actions when human beings are involved. The pivotal point of the problematic centers on the notion of interaction. According to Suchman, the traditional notion of interaction revolves around the concept of "communication between persons" (Suchman, 1987). However, in the cognitivist paradigm, interaction is restricted to the physical science concept of "reciprocal action or influence." A human learner who wants to work within an instructional system therefore has to assume the ontology of a machine for themselves in order to "learn" from the machine (Streibel, 1986). That is, a learner has to act as an information processor in order to "interact" with an instructional system. This result is a direct consequence of the cognitivist view of mind which separates meaning, imagination, and reason from a bodily basis (Johnson, 1987). This result, however, also places the human learner in a bind: Plans are generic and work with typical situations whereas purposeful actions such as learning are unique and interpreted in the context of specific interactions. Figure 4 shows the generic dimensions of instructional systems.

Insert Figure 4 about here

Put simply, the assumptions of the cognitivist paradigm conflict with the "life world" of the human learner because each learner brings a unique biography and history to each new learning experience and because each new learning interaction entails a unique, context-bound, sense-making process. Whereas a cognitive model of human learning is a rational reconstruction of minimally situated actions, the "life-world" of human learning is phenomenologically and contextually bound. Whereas a cognitive model of the processes of human learning is mechanical, the actual processes of human learning are experiential. And finally, whereas plans determine the meaning of actions in the cognitive model of human learning, the in situ interpretations of lived experiences by the participants determine the meanings of actions in the "life-world" of situated actions. A generic instructional plan in an instructional system can control a cognitive model of human learning but it cannot control the "life-world" of situated learning. Figure 5 summarizes the dimensions of the dilemma.

Insert Figure 5 about here

The problematic described above can be formulated as a question: Can human beings reason and learn in a situation where they have to deny the contextual nature of their thinking and knowing? Lucy Suchman provides a provocative answer: All real-world thinking and knowing (and learning) entails a form of context-bound and embodied, situational action and not plan-based interaction. Let's look at her arguments more closely.

"All activity, even the most abstract," claims Suchman, "is fundamentally concrete and embodied" (Suchman, 1987). Furthermore, "all purposeful actions...[are] inevitably situated actions...and primarily ad hoc." By "situated actions," Suchman means simply "actions taken in the context of particular, concrete circumstances." This being the case, "plans as such neither determine the actual

course situated actions nor adequately reconstruct it" (Suchman, 1987).

I first encountered the problematic relationship between plans and situated actions when, after years of trying to follow Gagne's theory of instructional design, I repeatedly found myself, as an instructional designer, making ad hoc decisions throughout the design and development process. At first, I attributed this discrepancy to my own inexperience as an instructional designer. Later, when I became more experienced, I attributed it to the incompleteness of instructional design theories. Theories were, after all, only robust and mature at the end of a long developmental process, and, instructional design theories had a very short history. Lately, however, I have begun to believe that the discrepancy between instructional design theories and instructional design practice will never be resolved because instructional design practice will always be a form of situated activity (i.e., depend on the specific, concrete, and unique circumstances of the project I am working on). Furthermore, I now believe instructional design theories will never specify my design practice at anything other than the most general level.

My experience as an instructional designer raises a deeper question: Does the problematic relationship, which exists between instructional design theory and practice, also hold for instructional theories and practice? That is, is there a problematic relationship between an instructional strategy or plan embedded in an instructional system and the resulting instructional practice. Furthermore, is there a problematic relationship between learning theories and learning practice? I have no doubt that instructional theories and learning theories are legitimate abstractions from, and rational reconstructions of, instructional and learning actions. However, I am beginning to question whether instructional theories or learning theories should be used to develop plans to prescribe instructional and learning actions. This dilemma is particularly poignant because I have been professionally trained to believe that:

1. an instructional strategy can and should be designed into an instructional

system,

2. an instructional strategy or plan in an instructional system is the best (and some would say only) hope for guaranteeing a change in the cognitive structures and operations of the learner (Heinich, 1988).

Lucy Suchman's ideas help clarify the problematic as well as help reframe the problem.

Plans and Situated Actions

Suchman first analyzes how plans are conceptualized in the cognitivist paradigm and then describes an alternative paradigm for how plans actually operate in human beings. In the cognitivist paradigm, plans are believed to be "prerequisite to and prescriptive [of] action, at every level of detail," because the "organization and significance of human action [resides] in [the] underlying plans" (Suchman, 1987). Furthermore, in the cognitivist paradigm, mutual intelligibility between human beings reduces to (Suchman, 1987):

> A matter of reciprocal intelligibility of our plans, enabled by common conventions for the expressions of intent, and shared knowledge about typical situations and appropriate actions.

Shared knowledge structures, typical situations, and appropriate actions are, therefore, external and prior to the same things in other people. Furthermore, two people can only understand each other when they share the same symbolic representations about typical situations and appropriate actions. Intent here is tied to the plan of action for typical, and therefore context-free, situations. Figure 6 sketches out these ideas.

Insert Figure 6 about here

The problematic in the cognitivist point-of-view arises because the lived experience of two persons are not made up of identical representations. Suchman's

argument here is ultimately based on an appeal to experience because human beings have no privileged way of knowing whether an identity relationship exists between the cognitive representations of different people. Our phenomenological experience, on the other hand, tells us that our knowledge always entails specific, contextual experience, and our actions always proceed on the basis of context-sensitive, embodied skills and not rationally-constructed plans.

Suchman clarifies the problematic between plans and situated actions by claiming that (Suchman, 1987):

> While the course of action can always be projected or reconstructed in terms of prior intentions or typical situations, the prescriptive significance of intentions for situated actions is inherently vague...because we can state our intentions without having to describe the actual course of events.

Plans, in other words, say more about our reasoning about action than about the actual course of events. Suchman, therefore, claims that (Suchman, 1987):

> The coherence of situated actions is tied in essential ways not to individual predispositions or conventional rules but to local interactions contingent on the actor's particular circumstances.

Let us use our example of a learner interacting with an instructional system. Extrapolating from Suchman's arguments, the coherence of the learner's experience in this situation is not tied in essential ways to the instructional designer's intent (no matter how detailed or explicit these intentions are spelled-out as instructional objectives) nor to the instructional plan built into the instructional system. Rather, the coherence of the learner's instructional experience is tied to the sense that such a learner constructs out of the actual situation (of which the instructional system is just a part). Hence, the sense that this learner at this point in time and in this situation will make out of the learning situation cannot be predicted or even assumed to be understood by an instructional designer who is not part of the actual situation. The best an instructional designer can do is create an instructional environment where the learner's processes of situational sense-making are enhanced. What does this mean for an instructional designer? Suchman again provides a

tentative answer.

Suchman considers face-to-face human interaction to be the "paradigm case for [all] communication...[because it is] organized for maximum context sensitivity" (Suchman, 1987). Furthermore, face-to-face communication "brings that context-sensitivity to bear on problems of skill acquisition...for just those recipients on just those occasions" (Suchman, 1987). Face-to-face human communication therefore becomes the means through which actions in a unique situation for unique a learner are connected to larger personal and interpersonal interactions and thereby made mutually intelligible. In her own research on how novices learn to use Xerox machines, Suchman has users team up and engage in a conversation with each other about the concrete situation. Meanings are constructed and negotiated in an ongoing dialogue, and the plans that the Xerox machine happens to contain are only treated as resources. Furthermore, sense making is intimately tied to the resolution of emergent dilemmas by each group of users. Suchman therefore concludes that the "conversation" between the users gave coherence to their situation rather than the plans built into the Xerox machines. John Seely Brown has taken Suchman's ideas and generalized them to encompass everyday cognition (Brown, 1988). See Figure 7 for a brief outline of these ideas.

Insert Figure 7 about here

What roles <u>should</u> plans play in the context of situated actions? For our purposes, what role should instructional plans play in the actual operation of instructional systems? Based on our discussion so far, we can begin to draw some tentative conclusions. First, we should stop treating plans as mechanisms that bring about subsequent actions:

1. in the case of human beings, plans should not be treated as "psychological mechanisms" that control and give meaning to subsequent behavior. Rather,

plans should be treated as "artifact[s] of our reasoning about actions." (Suchman, 1987)

2. in the case of instructional systems, instructional plans should not be used to control instructional interactions. Rather, plans should be used for:
   a. communicating about situated actions with other human beings,
   b. reflecting on and reconceptualizing situational actions.

In short, instructional plans should be used by both instructional designers and instructional users as resources for future situated actions.

What do these tentative conclusions imply? How can one design instructional systems where instructional plans operate as resources for the learners and not as controlling mechanisms? Suchman's situated-action paradigm again helps clarify the relationship between plans and situated learning.

Plans and Situated Learning

What has Suchman concluded so far? First, she has claimed that "every course of action depends in essential ways upon its material and social circumstances" (Suchman, 1987). Second, she has claimed that face-to-face communication and collaborative action are essential for sense-making in any situation. Finally, she has claimed that our knowledge of the physical and social worlds is inter-subjectively constructed by us. On the most general level, therefore, we can no longer view instructional systems as mechanisms that transmit knowledge or train skills in an information-processing sense of the term. Plans can play a communicative role but not a constitutive role in instructional interactions. To understand this more deeply, we have to examine Suchman's main propositions about plans.

First, Suchman admits that plans are representations of situated actions. However, these representations always come "before the fact in the form of imagined projections or recollected reconstructions" rather than as controlling

procedures during situated actions (Suchman, 1987). Hence, "plans orient us in situated actions" rather than prescribe the sequence of actions. Instructional strategies should, therefore, only be used to orient future teachers or learners for situated learning and not prescribe how to teach or how to learn. The actual embodied skills of teaching or learning still have to be worked out by the teacher or learner. In the case of instructional designers, instructional plans should only be used as general resources for the design and development of instructional systems. In the case of the operation of instructional systems, the instructional strategy should not control the actual instructional interaction. Finally, in the case of the human learner, the instructional strategy should be used to orient the human learner towards the material rather than controlling and evaluating each behavior. The instructional system in this scenario would act more like a coach than an instructor or tutor, and the human learner's role would be more that of a self-teacher than of a student. Figure 8 summarizes this point.

Insert Figure 8 about here

Is the foregoing suggestion about instructional systems a romantic ideal? Is it unrealistic? No, because the actual reality of designing an instructional system will always turn out to be a form of situational action. "When it comes down to the details," writes Suchman, "you effectively abandon the plan and fall back on whatever embodied skills are available to you" (Suchman, 1987). The same can be said for instruction and learning. When an instructor or a learner gets down to the details of teaching or learning, the respective theories of instruction or learning are abandoned and the instructor or learner falls back onto his or her embodied skills in the situation. An instructional designer would, therefore, do well to provide the learner, using an instructional system, with the appropriate resources to develop the learner's embodied self-teaching skills.

The suggestion that instructional systems should help learners develop embodied learning strategy skills sounds remarkably like the rhetoric about learning strategies design (O'Neil, 1978; O'Neil & Spielberger, 1979). However, one cannot design plans to instruct learning-strategy skills either. Suchman clarifies this point by saying (Suchman, 1987):

> It is frequently by only acting in a present situation that its possibilities become clear....In many cases, it is only after we encounter some state of affairs that we find to be desirable (e.g., a 'teachable moment' in a classroom for a teacher) that we identify that state as the goal towards which our previous actions, in retrospect, were directed all along.

An instructional designer cannot therefore predict which aspect of the instructional plan or which feature of the instructional system will be interpreted by the learner as a learning event, and so cannot design a plan for developing learning strategies. An instructional designer can, however, create a learning environment where learning strategies are used as resources by the learner. In a computer-based reactive learning environment called MENDEL which I and my colleagues are developing at the University of Wisconsin, a computer program helps students compare their intermediate hypotheses about genetics experiments against the data that the computer generates (Streibel et al., 1987). The program does not tutor students about the procedures or solve the problems for them, rather it offers advice on how to check their ideas. The program does this in spite of the fact that it contains an expert systems component that could solve the problem the student faces in a more efficient manner. The distinction between a plan as an instructional algorithm and a plan as an instructional resource is a very subtle one but it definitely runs counter to Richard Clark's suggestion that the instructional design component of instructional systems is the most efficacious component as far as learning is concerned (Clark & Salomon, 1986).

Suchman also argues that plans are only constructed by people in actual situations when (Suchman, 1987):

> Otherwise transparent [i.e. situational] activity becomes in some way

> problematized...[That is], when situated action becomes in some way problematized, rules and procedures are explicated for purposes of deliberation [and communication] and the action, which is otherwise neither rule-bound nor procedural, is then made accountable to them.

Note that representations here do not stand in an essential relationship to actions. Rather, plans are social and rational reconstructions of problematized situated actions.

Teachers in the critical pedagogy and experiential learning traditions have long known how to problematize learning situations and use reflection to turn experience into further action (Shor, 1980; Kolb, 1984; Boud et al., 1985; Livingston et al., 1987). In each of these traditions, teachers use face-to-face dialogue in order to problematize some part of the world and then use reflection as a way to get beyond the immediate situation. Furthermore, in each of these cases, teachers develop a dilemma language with the learners in order to foster mindful action (Berlak & Berlak, 1981). The key elements in the critical pedagogy and experiential learning traditions that develop embodied skills are, therefore, context-bound discourse-practices, negotiation of the very language used to characterize and resolve dilemmas, and reflective action. Both discourse-practices and reflective actions go beyond any rules and procedures.

Instructional designers face a serious challenge from the critical pedagogy tradition because instructional designers are neither part of the actual instructional interaction that they create, nor are they able to articulate a plan to help students problematize, analyze, and reconceptualize the "life-world" of the learning situation. At best, instructional designers can only create simplified reactive learning environments where students work collaboratively to resolve artificial dilemmas.

Suchman's third proposition about plans and situated actions claims that "the objectivity of the situations in our actions is achieved rather than given" (Suchman, 1987). An instructional system that operates according to a plan made prior to face-to-face interaction, therefore, undermines the very processes by which the

objectivity of the physical and social worlds is apprehended by new learners. In the place of interpersonal construction of reality, such instructional systems offer a coercive rather than a constructive interaction. What can an instructional designer do about this? How can an instructional system avoid coercive interactions?

George Herbert Mead argued, as early as 1934, that the physical and social worlds are "constructed by us through language" (Suchman, 1987). It is therefore, through the medium of language, that a learner will construct and construe the objectivity of some part of the physical and social worlds. However, language is not a set of symbols communicated through a medium. Language itself is constructed out of social discourse-practices. It is therefore not enough for an instructional designer to simply communicate messages about the physical and social worlds to the learner via the instructional system. Such a point of view would still legitimize coercive communication. Suchman helps clarify this point.

"Our everyday practices," writes Suchman, "render the social world publicly available and mutually intelligible" (Suchman, 1987). Hence:

1. the objectivity of the physical and social worlds is "the product of systematic practices" (Suchman, 1987).
2. the source of the mutual intelligibility:
    a. does not rest on "pre-existing conceptual schemes,"
    b. is not the result of "a set of coercive rules or norms,"
    c. is based on a "common practices that produce typifications" (Suchman, 1987).

The best way to help learners make sense out of their learning situations is, therefore, to help them approach the learning situation as ethnographers. A learning situation is, after all, a kind of social practice, and learners are, in effect, in the position of field workers who want to get into the disciplinary subculture's lore of knowledge. Ethnomethodologies are useful for learners because they deal

with "how members of a group make sense" and "how...objectivity and mutual intelligibility [are] achieved" (Suchman, 1987). An instructional designer who wants to address the constraints of situational learning will therefore have to find ways of creating instructional systems that give learners a chance to act as ethnographers.

Suchman's final proposition about plans and situated actions deals with how "language...[is] a central resource for achieving the objectivity of situations." (Suchman, 1987):

> Language [she writes] is a form of situated action because the significance of an expression always exceeds the meaning of what actually gets said. The interpretation of an expression depends not only on its conventional or definitional meanings, not on that plus some body of proposition, but on the unspoken situation of its use.

Hence, plans which try "to guarantee a particular interpretation" by providing "exhaustive action descriptions" are bound to fail because (Suchman, 1987):

> There [are] no fixed set of assumptions...or background knowledge that underlie a given statement...[Hence] mutual intelligibility is achieved on each occasion of interaction with reference to situational particulars.

Suchman continues by claiming that "interpreting the significance is an essentially collaborative achievement" (Suchman, 1987). Mutual intelligibility, in fact, requires constant collaborative conversation. The reasons for this are simple. The significance of our everyday interactions contain inevitable uncertainties and our language entails inevitable miscommunications. The only way to catch these uncertainties and repair these miscommunications is to conduct constant and in situ conversations. Interactive instructional systems, even those that use artificial intelligence technologies to model the communications process, are of no help here because (Suchman, 1987):

> There is a profound and persisting asymmetry between people and machines, due to a disparity in their relative access to moment-by-moment contingencies that constitute the conditions of situated actions.

Human teaching and learning, therefore, require the presence of face-to-face

linguistic engagement. Suchman's conclusion is all the more significant because she applies it to the acquisition of a simple procedural skill (i.e., how to use a Xerox machine).

John Seely Brown's Epistemology of Situated Learning

So far, I have described Lucy Suchman's theory of plans and situated actions, and applied her ideas to the design and use of instructional systems. I would now like to end with a brief discussion of the epistemology of situated learning in order to give some direction for further work in this area. My task has is made easier by John Seely Brown who has generalized Lucy Suchman's ideas.

John Seely Brown is a colleague of Lucy Suchman at Xerox PARC and one of the founders of the field of Intelligent Tutoring Systems. Intelligent Tutoring Systems are the most sophisticated forms of instructional systems and incorporate ideas from cognitive science, computer science, and artificial intelligence.

John Seely Brown also studied how human beings actually learn in the presence of intelligent tutoring systems and concluded that Suchman's theory of situated action was a more adequate account of the phenomena than a cognitive theory of plans. He therefore began to formulate an epistemology of situational learning that is sensitive to the nature of situational action.

Brown first spells out how ordinary folks think about real-world problems. Ordinary folks, says Brown, (Brown, 1988):

1. act on concrete situations,
2. resolve emerging dilemmas,
3. negotiate the meanings of terms used to describe new situations,
4. and ultimately use socially-constructed plans as resources for each new situation.

Figure 9 summarizes some of these conclusions.

Insert Figure 9 about here

Brown then compares everyday cognition with expert cognition. Experts, according to Brown, are persons who have acquired a disciplinary subculture of knowledge and discourse-practice. The most interesting aspect of Brown's comparison is that everyday and expert cognition have very much in common. According to the cognitivist paradigm, however, expert plans and procedures are the very thing that distinguish experts from ordinary people. According to Brown, on the other hand, the only difference between expert and ordinary people is that experts have a set of model through which they act on situations; whereas, just plain folks act on situations with partial, and often incorrect, models. Both experts and everyday folks mix knowledge with use and belief in real-world situations and both socially-construct the objectivity of knowledge. Furthermore, everyday folks become experts through a socialization process of acquiring effective discourse-practices in situated actions just as experts do. Everyday folks do not become experts by acquiring expert knowledge or following expert rules (Dreyfus & Dreyfus, 1986)

Brown then spells out the epistemological shifts that take place when we move from a cognitivist paradigm to a situated learning paradigm. Figure 10 summarizes these shifts (Brown, 1988). I will only highlight those aspects of the paradigm shift that have a direct bearing on the design of instructional systems.

Insert Figure 10 about here

The most obvious epistemological shift is from knowledge to practice. Learning is no longer a matter of ingesting externally-defined, decontextualized objects, but a matter of developing context-bound discourse-practices. This means

the objectives of an instructional system can no longer be seen as a pre-defined end-point for learning, nor instructional tasks as a sine qua non of instructional interaction. Rather, objectives can only be seen as expectancies that constrain the direction the learner is going, and instructional tasks can only be seen as one of many activities the learner might choose to pursue.

The second epistemological shift is from problem-solving to dilemma-handling. This means that learning can no longer be viewed as a form of cognitive problem solving, but as a form of posing problems, formulating hypotheses and terms to handle the problem, negotiating criteria to evaluate the problem, and finally interpersonally resolving the problem. In some ways, the very word "problem" is inadequate in the situated learning paradigm because it reduces real-world dilemmas to cognitive puzzles that have an explicit solution built into them. Hence, the word "dilemma-handling" is a more adequate term.

The final shift that I want to mention involves the move from efficiency to rationality. Cognitive-based instructional systems, as I have shown in an earlier paper, are ultimately shaped by the economic criteria of systems efficiency rather than the qualitative criteria of excellence and substantive understanding (Streibel, 1986). Cognitive-based instructional systems, therefore, serve the "human interests" of someone other that the learner (Apple, 1975; Wolcott, 1977; Bullough, Goldstein, & Holt, 1984). In the situated learning paradigm, however, the learner is at the center of negotiating the meaning of their actions and therefore at the center of negotiating what is rational to them. An instructional system that is sensitive to the situated learning paradigm has to respect and encourage the very social-linguistic processes by which rationality is constructed. This is a tall order for instructional systems, even those as advanced as intelligent tutoring systems, because such systems have a very limited access to the "moment-by-moment contingencies that constitute the conditions of situated actions (Suchman, 1987). It is, however, a challenge that we as instructional designers will have meet if we

are to respect the way human beings actually learn.

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Cognitivist Paradigm

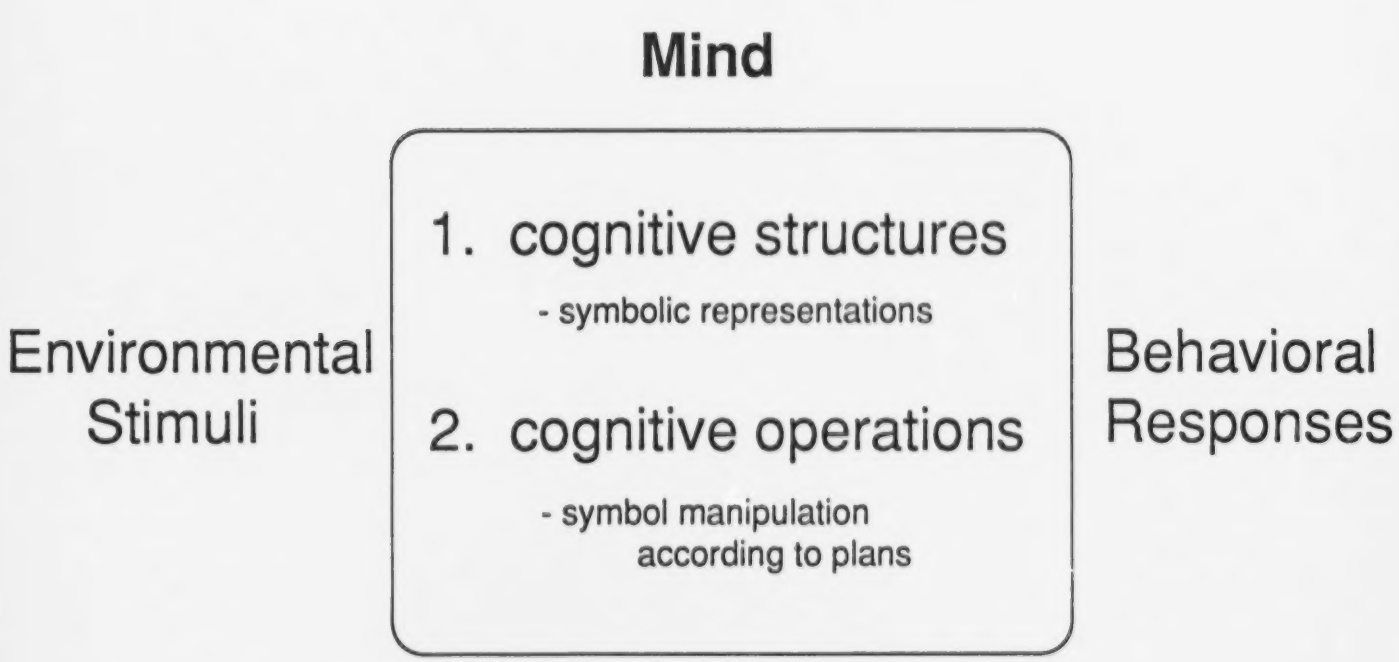

Figure 1

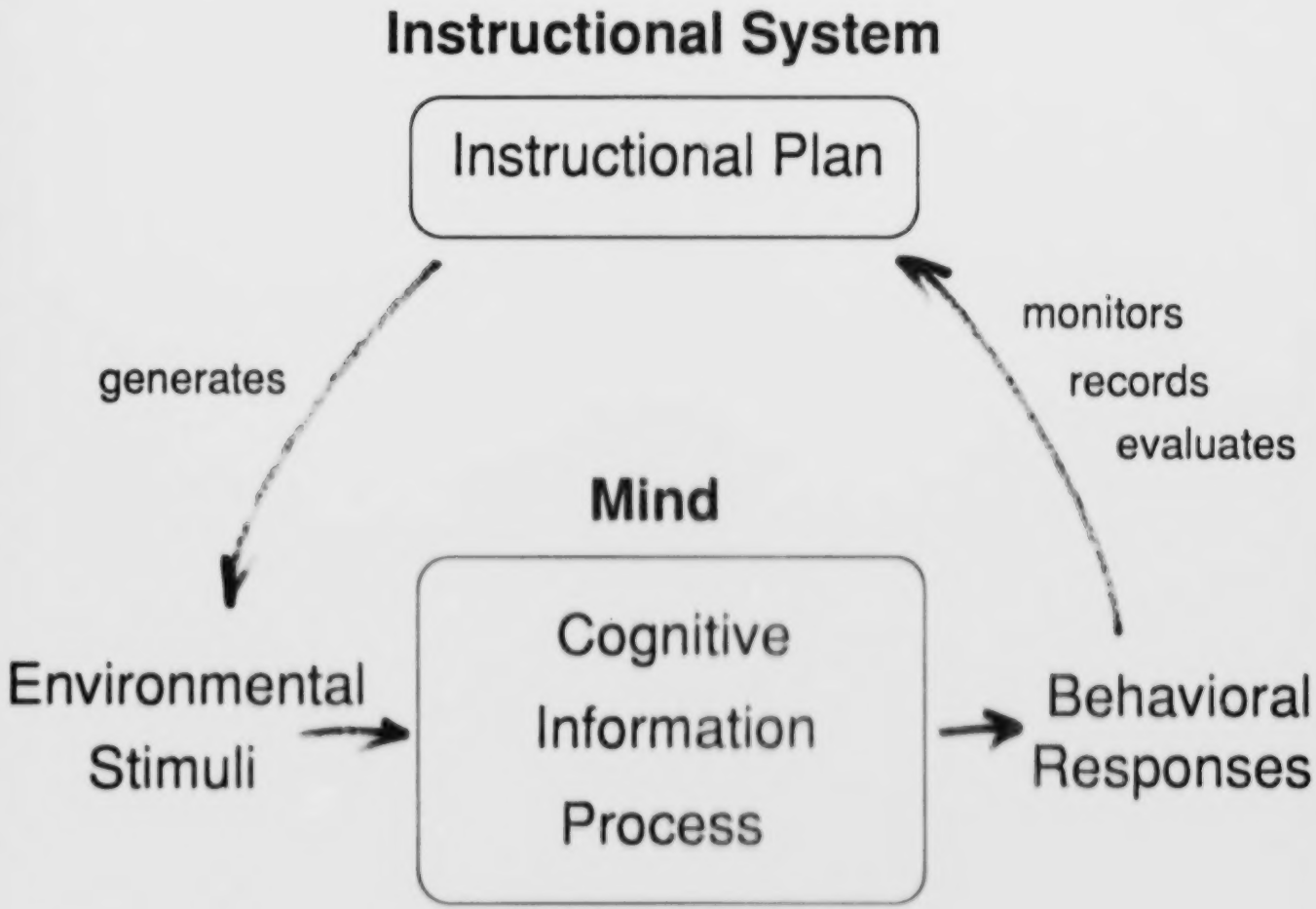
Instructional System
Instructional Plan
generates
monitors
records
evaluates
Mind
Environmental
Stimuli
Cognitive
Information
Process
Behavioral
Responses

Figure 2

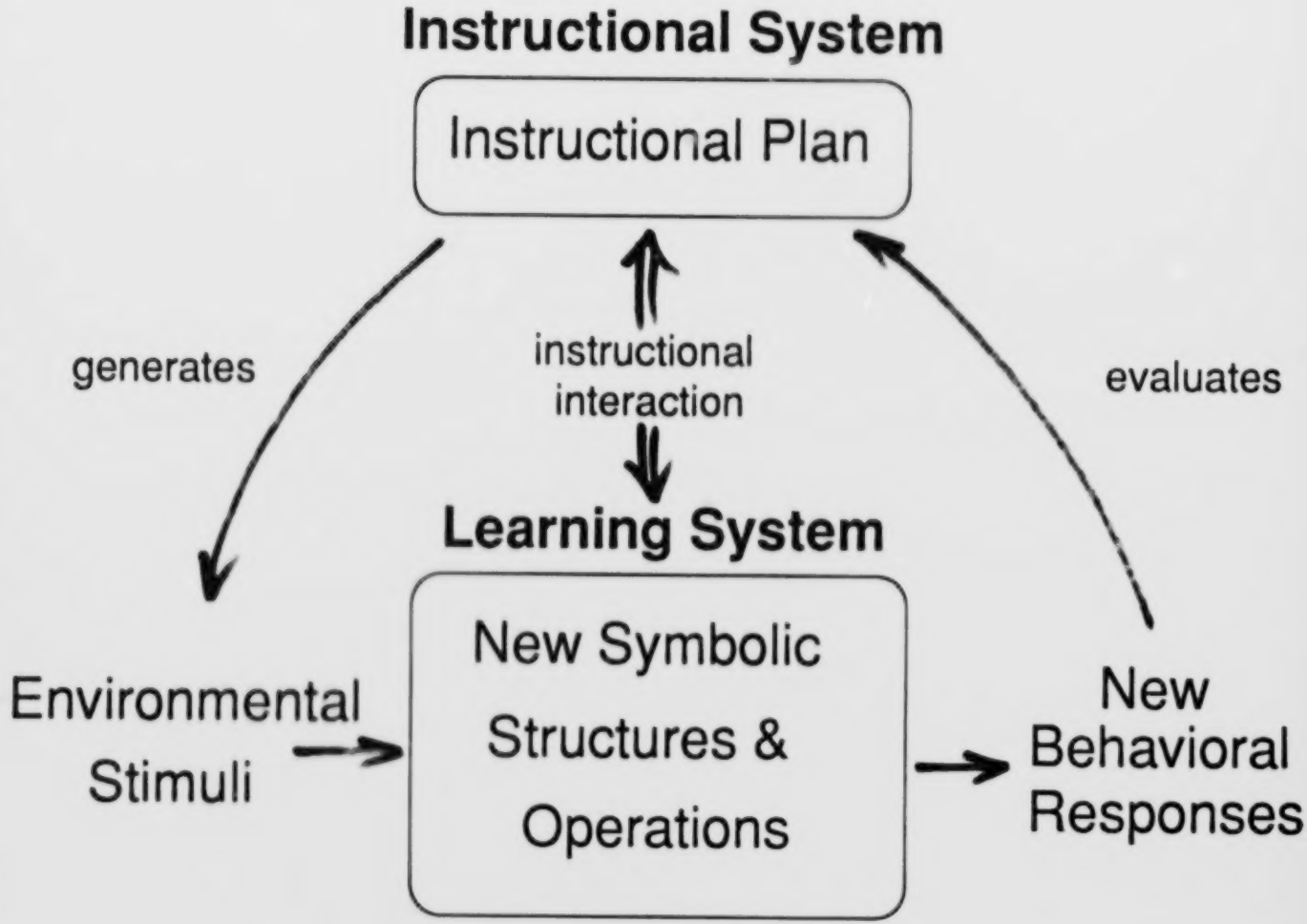
Instructional System
Instructional Plan
generates
instructional
interaction
evaluates
Learning System
Environmental
Stimuli
New Symbolic
Structures &
Operations
New
Behavioral
Responses

Figure 3

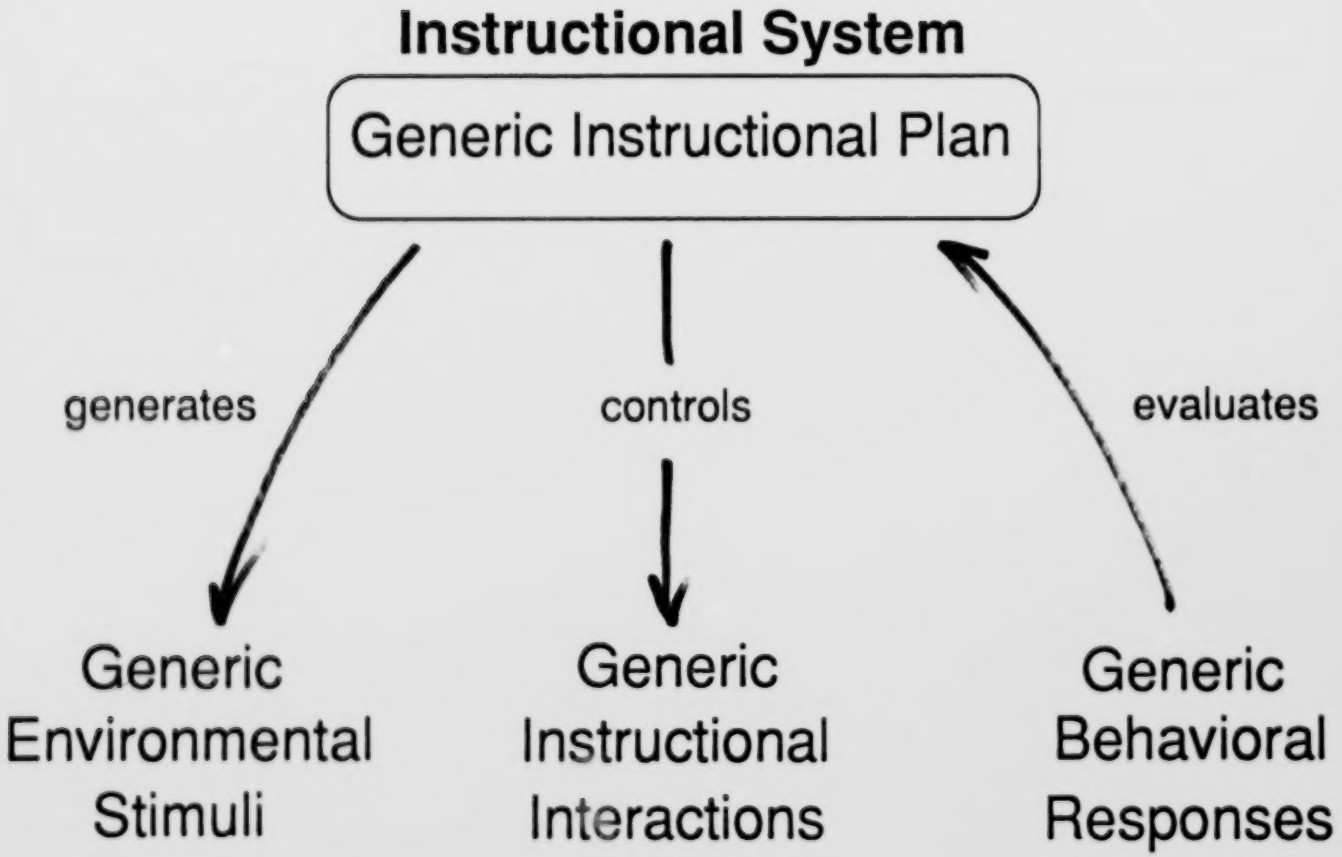
Instructional System
Generic Instructional Plan
generates
controls
evaluates
Generic Environmental Stimuli
Generic Instructional Interactions
Generic Behavioral Responses

Figure 4

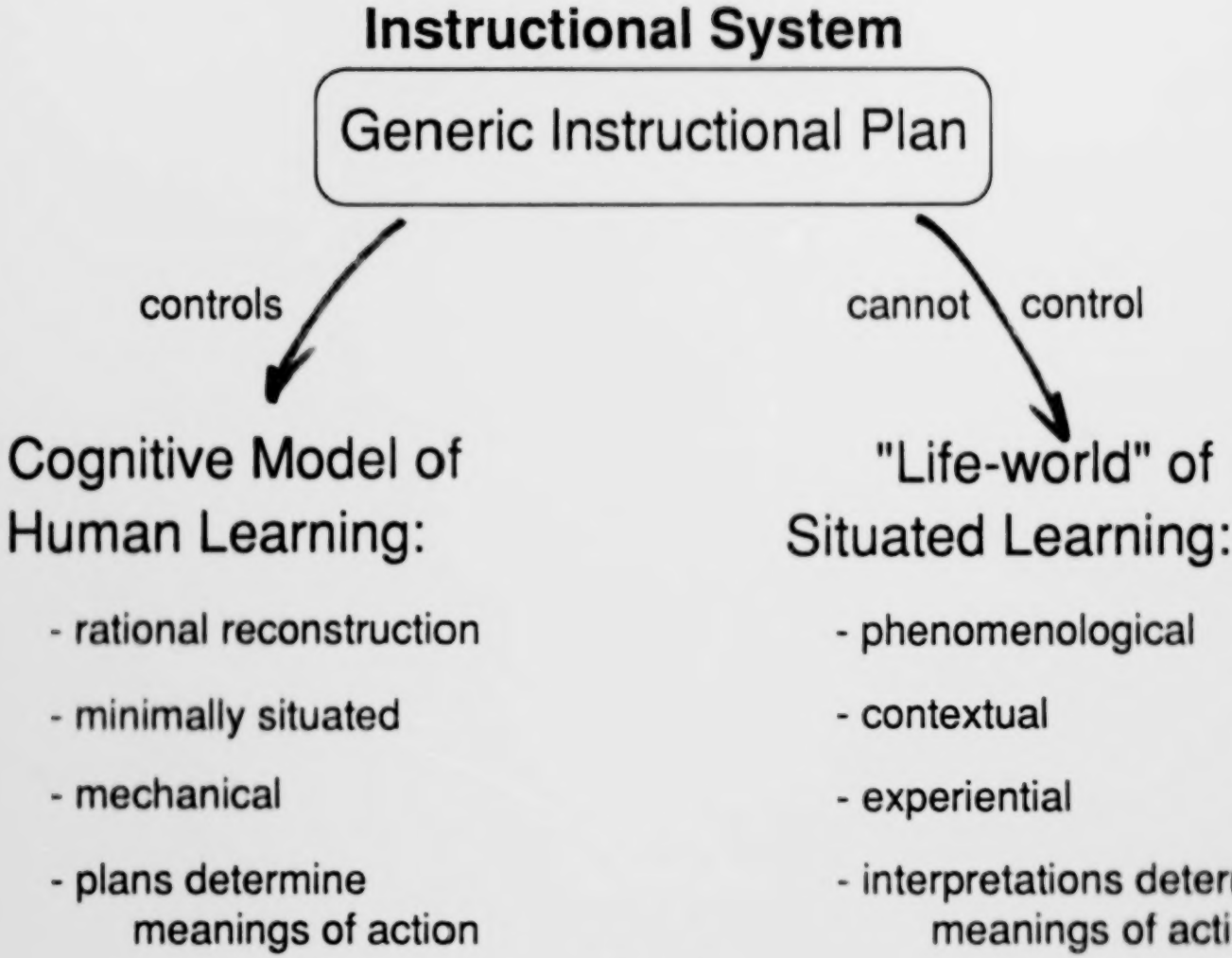
Instructional System
Generic Instructional Plan
controls
cannot control
Cognitive Model of Human Learning:
- rational reconstruction
- minimally situated
- mechanical
- plans determine meanings of action
"Life-world" of Situated Learning:
- phenomenological
- contextual
- experiential
- interpretations determine meanings of actions

Figure 5

Cognitive Learning Paradigm	Situated Learning Paradigm
Plans:	Plans:
1. pre-requisite to action or prescriptive of action	1. imaginative projection of action or rational reconstruction of action
2. at the heart of: - the organization of action - the significance of action	2. at the heart of: - reasoning about action - communication about action
3. strong link to intention	3. weak link to intention

Figure 6

Aspects of Everyday Cognition

John Seely Brown

1. act on situations
2. make sense out of concrete situations
3. resolve emergent dilemmas
4. negotiate the meaning of terms
5. use plans as resources
6. socially-construct physical and social reality

"conversation" with a situation

Figure 7

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Situational-Learning-Based Instructional Systems

1. use plans as resources to orient the learner towards action
2. include face-to-face dialogue to develop embodied skills
3. help learners problematize a situation & resolve emergent dilemmas
4. help learners develop situated discourse-practices
5. use collaborative learning structures
6. use language to construct physical and social reality

learners as "self-teachers" and "ethnographers"

Figure 8

Aspects of Cognition

John Seely Brown

Everyday Cognition

1. act on situations
2. contextual sense-making
3. resolve emergent dilemmas
4. negotiate meanings
5. use plans as resources
6. socially-construct physical and social reality

Expert Cognition

1. see through symbols
2. contextual sense-making
3. resolve ill-defined dilemmas
4. negotiate meanings
5. use plans as resources
6. socially-construct physical and social reality

expertise = acquiring a subculture

Figure 9

Epistemological Paradigm Shift

John Seely Brown

Cognitive Learning	Situated Learning
1. decontextualized	1. contextualized
2. knowledge	2. practice
3. goals	3. expectancies
4. tasks/problems	4. activities
5. solipsistic	5. interactional
6. formal	6. coordinated
7. definitional	7. constraints
8. problem-solving	8. dilemma handling
9. looking <u>at</u>	9. looking <u>through</u>
10. explicit theories	10. implicit theories
11. reference fixed	11. reference negotiated
12. efficiency	12. rationality

Figure 10